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PB1521 Hay Crop and Pasture Weed Management

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Contents

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Introduction

Hay crops and pastures are essential, highly valuable resources for Tennessee's beef cattle and dairy industries. Many ingredients must come together to insure optimum yields of high quality forage for beef and dairy animals. One of the key ingredients is a well-planned and well-executed weed management plan. Fortunately, compared to many agronomic and horticultural crops, forages are more competitive with weeds, so the likelihood of weed problems requiring yearly herbicide applications is lower.

Why, then, do weeds become troublesome in forage crops? Weeds can become troublesome because most grow rapidly, and many are prolific seed producers. Many of the seed produced can remain dormant for years. For example, research has shown that musk thistle, curly dock and pigweed can produce as many as 10,000, 40,000 and 120,000 seed, respectively, per plant in one growing season. Ultimately, weeds become troublesome in hay crops and pastures because they find room to grow. This room to grow may be due to a thin stand because of low seeding rate, poor internal drainage of the soil, droughty soils, low pH and/or poor fertility status or overgrazing.

Whether it is permanent grass pasture, alfalfa or other legumes, a bermudagrass hay field or sorghum-sudangrass hybrids, management of the crop for maximum competition is the first and most effective weed management input. In practically all cases, it is also the least expensive.

Weed Life Cycles

Common weeds that occur in Tennessee forage crops can be divided into four categories, based on their life cycle. Knowledge of weed life cycles is important in timing of certain weed control inputs such as clipping or application of herbicides. The four categories of weeds based on life cycle are:

Summer annuals - plants that germinate from seed in the spring, flower and produce seed in the mid to late summer, and die in the fall.
Winter annuals - plants that germinate from seed mostly in the late summer through winter, flower and produce seed in the late winter to spring, and die in the late spring to early summer.
Biennials - plants that complete their life cycle over two growing seasons. They germinate and produce a vegetative rosette the first year. The second year, the plants bolt, flower, produce seed and die.
Perennials - plants that produce a vegetative structure (taproot, tuber, bulb, rhizome, etc.) which allows them to live for more than two years. Most perennials also reproduce from seed.

Examples of common forage crop weeds and their classification according to life cycle are provided in Table 1.

Table 1. COMMON FORAGE CROP WEEDS CLASSIFIED BY LIFE CYCLE

SUMMER ANNUALS	WINTER ANNUALS	BIENNIALS	PERENNIALS
Spiny amaranth	Little barley	Common burdock	Brambles
Common cocklebur	Annual bluegrass	Wild carrot	Dandelion
Crabgrass	Cheat	Corn chamomile	Curly dock
Goosegrass	Chickweed	Common eveningprimrose	Wild garlic
Jimsonweed	Deadnettle	Cutleaf eveningprimrose	Goldenrod
Purple (perilla) mint	Henbit	Common mullein	Horsenettle
Pigweed	Horseweed	Bull thistle	Ironweed
Ragweed	Carolina geranium	Musk thistle	Buckhorn plantain
Smartweed	Virginia pepperweed	Swinecress	Pokeweed
Bitter sneezeweed	Annual ryegrass	Wild turnip	Red sorrel

WEED MANAGEMENT IN ALFALFA

Seedling Alfalfa

In Tennessee, alfalfa is planted either in late summer to early fall, or in the spring. In both cases, the alfalfa seedlings are small and grow relatively slowly. Most weeds are stronger competitors for light, water and nutrients. Because of this, weeds can quickly outgrow the young alfalfa and this can lead to retardation of growth or even death of alfalfa seedlings.

In late summer to early fall-planted alfalfa, winter annual weeds such as chickweed, henbit, deadnettle or ryegrass may be major problems because these weeds emerge at the same time, or shortly after, alfalfa seedlings. These weeds continue to grow after the alfalfa becomes dormant. They become well-established during the fall and winter and compete vigorously with alfalfa when it resumes growth in the spring. Summer annual weeds such as cocklebur, ragweed, morningglory, pigweed or lambsquarters rarely create problems in fall-seeded alfalfa because frost kills them.

Planting alfalfa in the spring can reduce winter annual weed problems, but may allow summer annual weeds to create problems. Weeds such as crabgrass and the broadleaf summer annuals previously mentioned can compete vigorously with spring- seeded alfalfa.

Established Alfalfa

As alfalfa becomes established, it is a stronger competitor with weeds. However, many weeds can create problems throughout the life of the stand. In the late fall to early winter, as alfalfa growth slows and it becomes dormant, chickweed, henbit, deadnettle and other winter annuals can flourish. In the spring to summer, particularly where the stand is less than optimum or where alfalfa weevil damage has been severe, summer annual broadleaf weeds, crabgrass and johnsongrass can become troublesome. As an alfalfa stand ages and becomes less dense, perennial broadleaf weeds such as curly dock and plantain usually become more numerous.

Cultural Control

As with any crop, cultural weed control measures are essential ingredients in an effective alfalfa weed management program. Cultural weed control measures either prevent weed problems or increase crop competition. Crop competition is the best and cheapest method of long-term alfalfa weed control.

Cultural weed control begins with field selection prior to planting alfalfa. Selecting fields with well-drained soils will promote more rapid seedling growth and greater success in establishing an optimum stand. Also, avoid fields that are infested with troublesome perennial weeds such as curly dock and buckhorn plantain. If these weeds cannot be avoided, they should be controlled prior to seeding alfalfa. For example, corn would be a good crop to grow while cleaning up a curly dock infestation. Likewise, a number of options (2,4-D, Weedmaster, etc.) exist in established grass pastures for control of annual and perennial broadleaf weeds. **Be sure to follow label directions regarding length of time to wait prior to seeding alfalfa, as alfalfa is sensitive to many herbicides used in rotational crops such as corn and grass pastures.**

Reduce weed problems by establishing a vigorous stand of seedling alfalfa. Stands that emerge and grow rapidly usually are not as weedy as less vigorous stands. Warm temperatures, adequate soil moisture, good seed inoculation and adequate soil fertility are essential to making alfalfa competitive with weeds. Be sure to plant weed free seed of a recommended alfalfa variety.

Once alfalfa is established, good management over the life of the stand will help reduce weed problems. Proper cutting, fertilizing and liming according to soil test recommendations, and control of the alfalfa weevil and other pests will increase the competitive ability of alfalfa. Do not use manure to fertilize alfalfa, because the nitrogen in manure will stimulate weed growth. Also, weed seed are often present in manure.

Chemical Control

Even with the best efforts toward cultural weed control, herbicides are often needed in alfalfa production. Chemical weed control should be used as a supplement to a good cultural program and not as a replacement for it.

Recommended herbicides for alfalfa and other hay crops are listed in Table 2, and expected weed response ratings are provided in Table 3. Herbicides differ in terms of weeds they control, whether they can be used in seedling or established alfalfa, whether they can be used in dormant or actively growing alfalfa, whether they are for alfalfa-grass mixtures or pure alfalfa only, and how long to wait after use before cutting hay. The herbicide label contains information that will help to safely and effectively use the chemical. Rates, proper application timings, precautions and restrictions are on the label. Be sure to study the label and follow the instructions carefully.

A summary of grazing and hay cutting restrictions for recommended alfalfa herbicides is provided in Table 4.

Table 2. Herbicides for Alfalfa and Other Legume Hay Crops (See Table 4 for Grazing and Hay Cutting Restrictions)

Crop and Application Timing	Herbicide	Rate/Acre Broadcast		Weeds Controlled, Remarks and Precautions
		Active Ingredient	Formulation	
ALFALFA-PREPLANT, NO-TILL	Gramoxone Max 3SL (Paraquat)	0.63-0.94 lbs.	26-43 ozs.	Use to control most annual and some perennial weeds prior to seeding. In sod, best results have been obtained with a split application (13-26 ozs./A, 10 days to 3 weeks prior to planting, followed by 13 ozs./A at planting). Apply in a minimum of 10 gals. of water/A. Add nonionic surfactant at 2 pts. per 100 gal. of spray mix.
	Touchdown/others (Glyphosate 3ae)	0.75-2.25 lbs. (**a.e.**)	32-96 ozs. 3ae	For control of most annual weeds and better control of perennial weeds than Gramoxone Max. On most perennial weeds, glyphosate performs better in the fall than in the spring. See label for rates on individual weed species.
	Roundup WeatherMax (Glyphosate 4.5ae)		22-64 ozs. 4.5ae	
Alfalfa, Birdsfoot Trefoil, Ladino or Red Clover, Lespedeza-PREPLANT	Eptam 7EC (EPTC)	3 lbs.	3.5 pts.	Apply preplant incorporated to control crabgrass, foxtails, seedling johnsongrass, chickweed, pigweed, and other annual grasses and small-seeded broadleaves. Do not use if small grains or forage grasses are to be seeded with the legume. If possible, spray and incorporate Eptam in one operation.
Alfalfa, Birdsfoot Trefoil, Ladino or Red Clover - SEEDLING	Butyrac 200 2SC (2,4-DB)	1-1.5 lbs.	4-6 pts.	Controls small seedlings of musk thistle, turnips, cocklebur and ragweed. Does not control chickweed or henbit. Treat before weeds exceed 3 inches tall and when legume has two or more trifoliate leaves.
Alfalfa, Birdsfoot Trefoil, Ladino or Red Clover - SEEDLING or ESTABLISHED	Kerb 50WP (Pronamide)	0.75-1 lb.	1.5-2 lbs.	On pure alfalfa stands, use to control chickweed and several winter grasses such as ryegrass, cheat and annual bluegrass. Apply after legumes have reached the trifoliate stage. Do not apply if temperatures are above 55 F.
Alfalfa, SEEDLING or ESTABLISHED	Pursuit 2AS or 70DG (Imazethapyr)	0.063-0.094 lb.	4-6 ozs. 2AS or 1.44-2.16 ozs. 70DG	Apply overtop in seedling or established alfalfa to control several annual broadleaf weeds and some annual grasses. Higher rate required for grass control. Seedling alfalfa must be in the 2 trifoliate stage or larger. Apply before most weeds exceed 3 inches in height. Good control of pigweed, morningglory, cocklebur, foxtails and seedling johnsongrass. Always add nonionic surfactant at 1 qt./100 gal. of spray mix.
Alfalfa-ESTABLISHED	Butyrac 200 2SC (2,4-DB)	1-1.5 lbs.	4-6 pts.	Controls small seedlings of musk thistle, turnips, cocklebur and ragweed. Does not control chickweed, henbit, plantain or dock. Treat before weeds exceed 3 inches tall.

(Continued on next page)

Crop and Application Timing	Herbicide	Rate/Acre Broadcast		Weeds Controlled, Remarks and Precautions
		Active Ingredient	Formulation	
Alfalfa, Clover, Birdsfoot Trefoil - SEEDLING OR ESTABLISHED	Poast 1.5E or Poast Plus 1E (Sethoxydim)	0.19-0.28 lb.	1-2.5 pts. 1.5E or 1.5-3.75 pts. 1E	Apply low rate overtop to seedling or established crop for control of crabgrass, goosegrass, foxtails and other annual grasses. Use higher rate for johnsongrass and bermudagrass. A second application may be needed for control of regrowth. Always add crop oil concentrate at 2 pts./A.
Alfalfa, Birdsfoot Trefoil - SEEDLING OR ESTABLISHED	Select 2EC (Clethodim)	0.094-0.125 lb.	6-8 ozs.	Apply overtop to control crabgrass, fall panicum, broadleaf signalgrass or other annual grasses and johnsongrass. Use 6 to 8 ozs./A in seedling alfalfa and 8 ozs./A in established alfalfa for annual grasses. Use 8 ozs./A for johnsongrass. Always add crop oil concentrate at 1 qt./A.
Alfalfa - DORMANT	Gramoxone Max 3SL (Paraquat)			Apply to dormant, pure alfalfa during late fall or winter months for control of chickweed, henbit, bluegrass and downy brome, and suppression of perennial grasses including orchardgrass, timothy and smooth brome. Use a minimum of 10 gallons of water by ground, or 5 gallons of water by air. Always add a nonionic surfactant at 0.25% (1 qt. per 100 gallons of spray mix.) Application to alfalfa that is not dormant, or has broken dormancy, may result in stand and/or yield reductions. Replanting may be necessary. Green alfalfa foliage present at the time of application will be burned. Make only one application per season.
FALL-SEEDED		0.19-0.28 lb.	8-12 ozs.	
ESTABLISHED		0.28-0.5 lb.	12-21 ozs.	
Alfalfa - DORMANT ESTABLISHED	Sencor or Lexone 4 L or 75 DF (Metribuzin)	0.5-0.75 lb.	1-1.5 pts. 4L, or 0.67-1 lb. 75 DF	Apply to dormant pure alfalfa or alfalfa-grass mixtures to control chickweed, henbit and several other broadleaf weeds. A partial reduction in grass stand may occur. Do not apply after new growth starts.
Alfalfa - ESTABLISHED or FIRST-YEAR, BETWEEN CUTTINGS	Gramoxone Max 3SL (Paraquat)	0.28 lb.	12 ozs.	Apply immediately after alfalfa hay is removed for control of many seedling broadleaf and annual grass weeds. Do not treat more than 5 days after cutting. Add surfactant at 1 pt./100 gal. of spray mix. Alfalfa foliage present at time of application will be burned. First year alfalfa stands and yields may be reduced if alfalfa is allowed to regrow more than 2 inches.

Table 3. Expected Weed Response to At-planting and Postemergence Alfalfa Herbicides

	Eptam	Butyrac	Pursuit	Poast or Poast Plus	Select	Gramoxone Between Cuttings
1. Annual grasses	8	0	7	9	9	7
2. Annual ryegrass	8*	0	--	8*	8*	NA
3. Johnsongrass Seedling	9	0	7	9	9	6
4. Rhizome	6	0	6	7	9	2
5. Nutsedge	8	1	3	0	0	2
6. Chickweed	9	2	--	0	0	NA
7. Cocklebur	2	8	8	0	0	6
8. Curly dock	0	1	--	0	0	2
9. Deadnettle	8	1	--	0	0	NA
10. Henbit	8	1	--	0	0	NA
11. Lambsquarters	7	4	5	0	0	6
12. Morningglory	4	8	8	0	0	7
13. Pigweed	7	6	9	0	0	7
14. Plantain	0	2	--	0	0	2
15. Ragweed	2	6	7	0	0	7
16. Musk thistle	--	7**	--	0	0	2

**Fall application*
***Newly-emerged seedlings*
NA = Not applicable
KEY TO RESPONSE RATINGS: *0=No control; 10=100% control; --=Data not available.*
Ratings are based on labeled rates of each herbicide, applied at the optimum timing for each weed.

Table 4. Grazing and Cutting Restrictions for Alfalfa Herbicides - Lactating Dairy Animals (Days to Wait)

Herbicide	Grazing	Hay Cutting
Butyrac 200		
Seedling	60	60
Established	30	30
Eptam	14	14
Gramoxone Max		
Between cuttings	30	30
Dormant	60	60
Kerb	120	120
Poast or Poast Plus	7	14
Pursuit	30	30
Roundup WeatherMax and other glyphosate formulations (burndown)	56	56
Select	15	15
Sencor/Lexone	28	28

WEED MANAGEMENT IN PASTURES

Good Pasture Management

Nowhere does the old adage "An ounce of prevention is worth a pound of cure" apply better than in pasture weed management. A well-managed, vigorously growing grass or grass-legume sod is a difficult situation for weeds to dominate. Good pasture management begins at establishment. Select well-adapted grass and/or legume species that will grow and establish rapidly. This will minimize the length of time for weeds to invade easily. Lime and fertilize by soil test results. Proper pH and nutrient status will help insure that the forage will grow rapidly and be more competitive with weeds.

Once the stand is established, manage grazing properly. Overgrazing is a common cause of weed problems. Heavy grazing pressure may favor weed growth over grass. Maintenance of favorable pH and fertility status continues to be as important in established stands as it is at planting. Broomsedge has long been associated with acid and/or low phosphate soils. Liming and fertilizing according to soil test, **combined with intensive grazing,** will reduce problems with broomsedge. If stocking rates are not sufficiently high enough to allow intensive grazing, supplement with clipping. Lastly, the value of timely clipping is often underestimated. Properly timed clipping will kill many annual broadleaf weeds if they are cut below the growing point. Clipping will prevent or reduce seed production by annual and perennial weeds and stimulate new forage growth, which is usually of higher quality than older, more mature forage.

Herbicides in Pastures

Herbicides sometimes are needed in spite of a producer's best efforts in pasture management. Weeds usually are more of a problem in pastures than in hay fields because of lower cutting frequency and generally lower fertility levels in pastures. Overall, the quality of many thousands of acres of pastures in Tennessee could be substantially improved with a well-planned, inexpensive herbicide program. For example, a properly-timed application of 2,4-D will give excellent control of musk thistle and buttercup, two of the most troublesome pasture weeds in Tennessee. Recommended herbicides for pastures in Tennessee are listed in Table 5.

Importance of Proper Spray Timing

Unfortunately, due to the diversity of weed species in most Tennessee pastures, one spray timing will not work for all weeds. For example a March application of 2,4-D, which gives excellent control of musk thistle and buttercup, will not control summer annual weeds such as common cocklebur and pigweed. Conversely, a summer application will not control winter annual weeds. It is, therefore, important to properly time herbicide applications to get the most for your money and time expenditures. Expected weed response ratings for weeds normally sprayed in the late winter to early spring are provided in Table 6, and in Table 7 for weeds normally sprayed in the late spring to summer.

Spray Volume

Over the past 20 years we have seen a substantial decrease in spray volumes particularly with row crop herbicides. Roundup WeatherMax, Select and several other herbicides actually perform better at low (10 gallons of water per acre) (GPA) volume than at high (20 GPA) volume. However, pasture herbicides such as 2,4-D, Grazon P+D, Weedmaster and others must be applied in high water volume (minimum of 20 GPA) for good performance. This is due to the nature of the chemicals, the leaf structure and orientation of many pasture weeds, and in many cases, the unevenness or rolling nature of pastures. Except for improper spray timing, insufficient water volume is the most frequent cause for lack of weed control with pasture herbicides.

Fall (November to early December) Spray Opportunities

Winter annual weeds such as chickweed, henbit and deadnettle; biennials such as musk thistle; and perennials such as buckhorn plantain and some of the buttercups, are normally sprayed in late-winter to early-spring. However, most of these weeds emerge during the fall and may actually be controlled just as effectively in November to early December. In the cases of henbit and chickweed, control with Weedmaster or Redeem R&P is much better in November than in March. This is particularly true during years when winters are mild allowing growth throughout much of January and February. Table 6 lists response ratings for selected weeds when sprayed in the fall.

In addition to equal or better control in many cases, the fall application may allow renovation (addition of clovers) the following February to March, after herbicide residues have diminished. Another benefit of fall applications is that the November timing allows safe application in certain drift sensitive pastures, such as those near tobacco transplant beds or float beds. Trade-offs or disadvantages of fall applications include no control of musk thistle, for example, seedlings that may germinate during intermittent, relatively warm periods during December, January and February following the spray application. Also, producers are cautioned to proceed with care on newly-seeded fall pastures. Grasses such as fescue, orchardgrass and timothy should not be sprayed with most herbicides until they have tillered. Also, if legumes are seeded in the fall, they will be killed by these herbicides.

Table 5. Herbicides For Pastures and Hayfields (See Table 9 for Grazing, Hay Cutting and Slaughter Restrictions)

Crop and Application Timing	Herbicide	Rate/Acre Broadcast		Weeds Controlled, Remarks and Precautions
		Active Ingredient	Formulation	
Bermudagrass - (only) DORMANT	Gramoxone Max 3SL (Paraquat)	0.28-0.47 lb.	12-20 ozs.	Apply to dormant bermudagrass for control or suppression of emerged winter annual weeds. For control of little barley, apply before the mid-boot stage. Add nonionic surfactant at 0.25% by volume.
Bermudagrass - (only) ESTABLISHED	Cimarron 60DF (Metsulfuron)	0.0038-0.011 lb.	0.1-0.3 oz.	Bermudagrass should be established at least 60 days prior to application. Apply before weeds are 4 inches tall or in diameter. Use 0.1 to 0.2 ozs./A for control of bitter sneezeweed, buttercup, Carolina geranium, common chickweed, dandelion, horseweed, plantain, curly dock and several others. For dogfennel, common yarrow, and musk thistle, use 0.2 to 0.3 ozs./A. Add nonionic surfactant at 1 to 2 pts./100 gal. of spray mix. Avoid application during spring green-up.
Orchardgrass - (only) ESTABLISHED	Cimarron 60DF (Metsulfuron)	0.0038-0.011 lb.	0.1-0.3 oz.	Orchardgrass should be established at least 6 months prior to application. Apply before weeds are 4 inches tall or in diameter. Use 0.1 to 0.2 ozs./A for control of bitter sneezeweed, buttercup, Carolina geranium, common chickweed, dandelion, horseweed, plantain, curly dock and several others. For dogfennel, common yarrow, and musk thistle, use 0.2 to 0.3 ozs./A. Add nonionic surfactant at 1 to 2 pts./100 gal. of spray mix. Cimarron will kill all legumes.
Newly Established, GRASS ONLY	2,4-D Amine 4L	0.5-1.0 lb.	1-2 pts.	Can be used on all forage grasses for control of buttercup, thistles, wild turnip, horseweed and plantain. Apply when weeds are less than 4 in. tall and actively growing. This treatment will kill clovers and other legumes in the seedling stage.
	Grazon P+D (Picloram + 2,4-D) **For use only in approved TN counties. See pages 16-17.**	0.14 + 0.5 – 0.2 + 0.75 lb.	2-3 pts.	This is a Restricted Use Pesticide (RUP) which requires a license to purchase and apply. Apply after newly seeded grasses have begun to tiller and develop a secondary root system (usually around the 4-leaf stage of grasses). Use for thistles, horsenettle, ragweed, cocklebur, buttercup and others. Will kill pasture legumes, but reseeding may be possible one year later. On most weeds apply in March to mid-summer when actively growing. Most perennials will require higher rates (see label). Always add non-ionic surfactant at the rate of 1 quart/100 gallons of spray mix.
	Redeem R&P (Triclopyr + Clopyralid)	0.56 + 0.19 - 0.84 + 0.28 lb.	2-3 pts.	For use when products containing 2,4-D are not an option. Apply after newly seeded grasses have begun to tiller and develop a secondary root system (usually around the 4-leaf stage of grasses). Use for thistles, ragweed, cocklebur, buttercup and others. Will kill pasture legumes, but reseeding is usually possible the next growing season. On most weeds apply in March to mid-summer when actively growing. Most perennials will require higher rates (see label). Always add non-ionic surfactant at the rate of 1 quart/100 gallons of spray mix.
Established, GRASS and WHITE CLOVER	2,4-D Amine 4L OR 2,4-D Low Volatile Ester 4EC	0.75-1.0 lb.	1.5-2 pts.	Can be used on all established mixtures of grass and white clover. Apply in March to early April for control of buttercup, musk thistle, dandelion and plantain. Apply in June for control of cocklebur, bitter sneezeweed, pigweed, spiny amaranth and ragweed. NOTE: The amine formulation is much less volatile than low volatile ester formulations, but is less effective on hard-to-control species such as thistles, plantain and other perennials.

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Crop and Application Timing	Herbicide	Rate/Acre Broadcast		Weeds Controlled, Remarks and Precautions
		Active Ingredient	Formulation	
Established, GRASS and ANNUAL LESPEDEZA	2,4-D Amine 4L	0.5-0.75 lb.	1-1.5 pts.	Can be applied when lespedeza is 3 to 7 inches tall (normally mid-June). Earlier applications will result in more severe injury.
Established, GRASS ONLY	2,4-D Ester 4EC	2.0 lbs.	2 qts.	For wild garlic control, apply in October to mid-November or March to mid-April when daytime temperature is at least 65 F. Repeat twice annually for 2 years to eliminate wild garlic. This rate of 2,4-D will kill all legumes, including established white clover.
	Grazon P+D (Picloram + 2,4-D) **For use only in approved TN counties. See pages 16-17.**	0.14 + 0.5 – 0.2 + 0.75 lb.	2-3 pts.	This is a Restricted Use Pesticide (RUP) which requires a license to purchase and apply. Use for thistles, horsenettle, ragweed, cocklebur, buttercup and others. Will kill pasture legumes, but reseeding may be possible one year later. On most weeds apply in March to mid-summer when actively growing. Most perennials will require higher rates (see label). Always add non-ionic surfactant at the rate of 1 quart/100 gallons of spray mix.
	PastureGard (Triclopyr + Fluroxypyr)	0.38 + 0.13 - 1.5 + 0.5 lb.	2-8 pts.	Use when brush or woody plants have begun to establish in pasture. May be tank-mixed with other products to improve control of herbaceous weeds. Especially good on blackberry and other woody plants. For woody plant control, apply in summer after plants have fully leafed out. For blackberry, apply before first flower, or in summer after fruit drop when good moisture is available. Usual broadcast rates for woody plant control: 3-4 pints/acre. May be used on fencerows and for individual plant treatments of trees and brush. Always add non-ionic surfactant at the rate of 1 quart/100 gallons of spray mix.
	Redeem R&P 3SL (Triclopyr + Clopyralid)	(0.28 + 0.094) to (0.84 + 0.28 lb.)	1-3 pts.	Apply postemergence in permanent grass pastures. Good control of chickweed, cocklebur, henbit, buckhorn plantain, musk thistle, bull thistle and several other weeds. Always add nonionic surfactant at the rate of 1 qt/100 gal. of spray mix. Will kill all pasture legumes.
	Surmount (Picloram + Fluroxypyr) **For use only in approved TN counties. See pages 16-17.**	0.13 + 0.13- 0.5 + 0.5 lb.	1.5 – 6 pts.	This is a Restricted Use Pesticide (RUP) which requires a license to purchase and apply. Use for brush control plus residual broadleaf weed control. Especially good on blackberry, ironweed, horsenettle, thistles, etc. For woody plant control, apply in summer after plants have fully leafed out. For blackberry, apply in summer after fruit drop when good moisture is available. Usual broadcast rates for woody plant control: 3-4 pints/acre. Always add non-ionic surfactant at the rate of 1 quart/100 gallons of spray mix.

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Crop and Application Timing	Herbicide	Rate/Acre Broadcast		Weeds Controlled, Remarks and Precautions
		Active Ingredient	Formulation	
Established, GRASS ONLY Cont.	Weedmaster 3.87SL (Dicamba + 2,4-D Amine)	(0.125 + 0.36) to (0.5 + 1.4 lbs.)	1-4 pts.	Will usually give control of a wider range of weeds than either herbicide alone. Only partially effective on difficult-to-control perennials such as dock, brambles and horsenettle. High rates (see label) required for difficult-to- control species. Will kill all pasture legumes.
Sorghum-Sudangrass Hybrids - POSTEMERGENCE	AAtrex 4L or 90WDG (Atrazine)	2.0 lbs.	2 qts. or 2.2 lbs.	Apply overtop once a stand is obtained and before weeds exceed 1.5 inches in height. Do not apply after crop is 12 inches in height. See label for surface and groundwater protection measures. Atrazine is not labeled on sweet sorghum.

Table 6. Expected Weed Response to Pasture Herbicides

	LATE WINTER TO EARLY SPRING APPLICATIONS					FALL (NOVEMBER TO EARLY DECEMBER) APPLICATIONS				
	2,4-D Ester	2,4-D Amine	Grazon P+D*	Redeem R&P	Weedmaster	2,4-D Ester	2,4-D Amine	Grazon P+D*	Redeem R&P	Weedmaster
1. Buttercups	9	8	9	9	9	9	8	9	9	9
2. Common chickweed	2	1	8	8	5	3	2	9	9	8
3. Dandelion	9	8	9	8	8	9	8	9	8	8
4. Curly dock	4	3	9	-----	4	5	3	9	-----	6
5. Wild garlic	8	6	5	-----	6	8	6	5	-----	6
6. Henbit	2	1	8	8	4	3	2	8	8	7
7. Horseweed	9	8	9	9	9	9	8	9	9	9
8. Broadleaf plantain	8	7	8	8	9	8	7	8	8	9
9. Buckhorn plantain	7	6	8	8	8	7	6	8	8	8
10. Red sorrel	3	3	8	7	5	3	3	8	8	6
11. Bull thistle	8	7	9	9	8	9	7	9	9	9
12. Musk thistle	8	7	9	9	7	9	8	9	9	8

***Key to Response Ratings**: 0=No control; 10=100% Control; -- = Data not available*

Ratings are based on labeled rates of each herbicide, applied at the optimum time for each weed.

*For use only in approved TN counties. See pages 16 and 17.

Table 7. Expected Weed Response to Pasture Herbicides Late-spring to Summer Applications

	2,4-D Ester	2,4-D Amine	Grazon P+D*	Redeem R&P
1. Spiny amaranth	9	7	7	4
2. White heath aster	7	5	8	----
3. Bitter sneezeweed	8	7	9	----
4. Brambles	4	2	6	6
5. Chicory	5	4	8	8
6. Common cocklebur	9	9	9	9
7. Goldenrod	6	4	8	6
8. Horsenettle	3	2	9	5
9. Tall ironweed	7	6	6	6
10. Jimsonweed	8	7	4	9
11. Common lambsquarters	9	9	9	8
12. Milkweed	3	2	5	----
13. Oxeye daisy	5	4	8	----
14. Pigweeds	9	9	7	4
15. Pokeweed	5	4	4	2
16. Purple (perilla) mint	8	7	7	----
17. Ragweeds	9	8	9	9
18. Smartweed	7	5	----	----
19. Sumpweed	9	8	7	8
20. White snakeroot	6	6	8	----
21. Wingstem	8	7	8	----

***Key to Response Ratings**: 0=No control; 10=100% Control; -- = Data not available*

Ratings are based on labeled rates of each herbicide, applied at the optimum time for each weed.

*For use only in approved TN counties. See pages 16 and 17.

Grazon P+D and Surmount Guidelines for Tennessee

Grazon P+D and Surmount are marketed in a limited number of counties in Tennessee. These counties were chosen because they have little or no acreage of cotton, tobacco, and certain other sensitive crops or because the counties have had a history of Grazon P+D use without non-target problem. The University of Tennessee does not recommend the use of and Dow AgroSciences does not sell Grazon P+D or Surmount outside of these counties. See figure on page 17 of this publication. **NOTE:** These are the counties approved at the time of printing. Contact your County Extension Agent for the latest list.

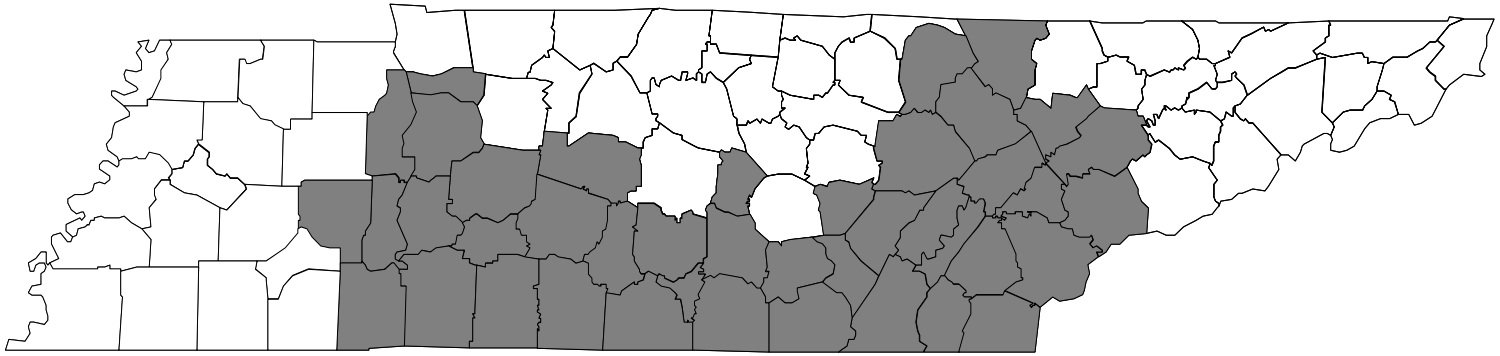
Grazon P+D and Surmount are safe on established cool- and warm-season grasses used for pasture and hay production. They provide good control of a number of broadleaf weeds. Both provide some residual control. The residual effect will depend on temperature, soil type, moisture and plant sensitivity. These products will kill all pasture legumes and re-seeding should not be attempted within one year of application.

Grazon P+D and Surmount are restricted use pesticides, requiring applicators to have a commercial pesticide applicator certification card. They are restricted use due to the risk of injury to susceptible, non-target plants. Broadleaf crops, such as cotton, tobacco, tomatoes and others, are very sensitive to both herbicides. Care must be taken in use of hay from fields treated with Grazon P+D or Surmount. Do not spread manure from animals which have grazed on, or have been fed hay, on fields where picloram sensitive crops will be grown. Due to this sensitivity, it is recommended to use a sprayer dedicated to pasture applications only. Read and understand the label restrictions before use of this product.

Check List for Grazon P+D and Surmount Use
If all of the following are answered as "satisfactory," then an application of Grazon P+D or Surmount may be recommended.

- ☐ Is the site located within one of the approved counties for this herbicide?
- ☐ Does the applicator have a restricted use applicator certification or use a custom applicator?
- ☐ Is the site properly buffered from sensitive crops and other off-target species, including ornamentals?
- ☐ Is there surface water (ponds or streams) on site? If so, does the applicator know to keep a 50 foot buffer?
- ☐ Has the required personal protective equipment been prepared?
- ☐ Are the wind conditions calm enough to prevent drift?
- ☐ Is rain in the forecast? If so, the application should be delayed.
- ☐ Does the applicator / land manager understand the grazing, haying and manure restrictions (see label)?
- ☐ Is there a risk of surface runoff of the herbicide, including erosion? (e.g., does the site contain steep slopes with bare soil?) If so, the application is not recommended.
- ☐ Is the site a permanent pasture? (If there is intention to rotate to any field crops, ornamentals, tobacco, vegetables or other vegetation, application is not recommended.)
- ☐ Does the applicator understand the sprayer cleanout requirements?

Tennessee Counties Approved for
Grazon P+D and Surmount Application*



*Shaded counties are approved for Grazon P+D and Surmount application.

Anderson	**Coffee**	**Hamilton**	**Lawrence**	**McMinn**	**Rhea**
Bedford	**Cumberland**	**Hardin**	**Lewis**	**Meigs**	**Roane**
Benton	**Decatur**	**Henderson**	**Lincoln**	**Monroe**	**Sequatchie**
Bledsoe	**Fentress**	**Hickman**	**Loudon**	**Moore**	**Scott**
Blount	**Franklin**	**Houston**	**Marion**	**Morgan**	**Van Buren**
Bradley	**Giles**	**Humphreys**	**Marshall**	**Perry**	**Wayne**
Cannon	**Grundy**	**Knox**	**Maury**	**Polk**	**Williamson**

SPOT SPRAYS

Some particularly hard-to-control weeds, such as multiflora rose and brambles, can best be controlled with spot applications using hand-held equipment and high volume applications. If possible, control these weeds before they infest the entire field. Recommended spot application programs for specific weeds are provided in Table 8. All of these recommended herbicides are cleared for use in pastures. **Remember that for control of weeds in fencerows to which cattle have access, you must use a herbicide that is registered for pasture use.**

Table 8. Spot Treatments For Specific Weeds in Pastures (See Table 9 for grazing, hay cutting and slaughter restrictions)

Weed	Herbicide	Amount of Formulation Per 1 gal.	100 gal.	Remarks
Bermudagrass	Roundup Ultra 4L (Glyphosate)	5 Tbsp.	2 gal.	Apply a 2% mixture of Roundup Ultra in water to actively growing bermudagrass when seed heads are present. Retreatment may be required. See labels for other glyphosate formulations.
Brambles	Cimarron 60DF (Metsulfuron)	0.01 oz.	1 oz.	Apply as a foliar spray to runoff in the spring after brush is fully leafed. Complete coverage of all foliage and stems is required for control. On tall, dense stands it is often necessary to spray from both sides to get adequate coverage. Add a nonionic surfactant at the rate of 1 to 2 qts./100 gal. of spray mix.
	Crossbow 3EC (2,4-D ester+ Triclopyr ester)	2.5 to 4 Tbsp.	1 to 1.5 gal.	Apply as a foliar spray to runoff in the spring after brambles are fully leafed. Complete coverage of leaves and green stems is needed.
	PastureGard (Triclopyr + Fluroxypyr) + surfactant	1.3 to 2 oz. + 4 tsp.	1 to 1.5 gal. + 2 qt.	Apply as a foliar spray either before first flower, or after fruit drop in summer. Apply when moisture is adequate. Spray to wet, avoiding runoff. Spray all leaves and branches
	Remedy 4EC (Triclopyr) + surfactant	4 tsp. + 4 tsp.	2 qt. + 2qt.	Apply as a foliar spray to thoroughly cover all leaves and green stems in the spring after brambles are fully leafed.
	Roundup Ultra 4L (Glyphosate)	2.5 to 4 Tbsp.	1 to 1.5 gal.	Apply as a foliar spray in late summer or early fall after berries have set or dropped. See labels for other glyphosate formulations.
Buckbrush	Cimarron 60DF (Metsulfuron)	0.01 oz.	1 oz.	University of Tennessee demonstrations have shown good performance of Cimarron on buckbrush. See remarks for Cimarron under Brambles section.
Honeysuckle	2,4-D Amine 4L	2 Tbsp.	3 qts.	Apply as a foliar spray when plants are actively growing, prior to bloom stage. Thorough coverage is needed. Add a nonionic surfactant at the rate of 2 qts./100 gal. of spray mix (2 Tbsp./1 gal.).
	Banvel 4L (Dicamba)	2.5 Tbsp.	1 gal.	
	Remedy 4EC (Triclopyr) + surfactant	4 tsp. + 4 tsp.	2 qt. + 2qt.	Apply as a foliar spray when plants are actively growing, prior to bloom stage. Complete coverage is necessary.
	Roundup Ultra 4L (Glyphosate)	2.5 to 4 Tbsp.	1 to 1.5 gal.	Apply as a foliar spray when plants are actively growing, at or beyond the bloom stage. Use the higher rate for plants that have reached the woody stage. Thorough spray coverage is needed. See labels for other glyphosate formulations.

(Continued on next page)

Weed	Herbicide	Amount of Formulation Per 1 gal.	100 gal.	Remarks
Ironweed	Crossbow 3EC (2,4-D ester+ Triclopyr ester)	2.5 to 4 Tbsp.	1 to 1.5 gal.	Apply as a foliar spray in late spring to early summer when plants are actively growing. Thorough coverage is needed.
	PastureGard (Triclopyr + Fluroxypyr) + surfactant	1.3 oz. + 4 tsp.	1 gal. + 2 qt.	Apply as a foliar spray in late spring through early summer when plants are actively growing.
Multiflora Rose	Cimarron 60DF (Metsulfuron)	0.01 oz.	1 oz.	See remarks under brambles section for Cimarron.
	Crossbow 3EC (2,4-D ester+ Triclopyr ester)	2.5 to 4 Tbsp.	1 to 1.5 gal.	Apply as a foliar spray to runoff in spring when plants are at the early to mid-flower stage. Complete coverage of leaves and green stems is needed.
	PastureGard (triclopyr + fluroxypyr) + surfactant	1.3 to 2.6 oz. + 4 tsp.	1 to 2 gal. + 2 qt.	Apply as a foliar spray after plants have complete foliage. Apply when moisture is adequate. Spray to wet, avoiding runoff. Spray all leaves and branches.
	Remedy 4EC (Triclopyr) + surfactant	4 tsp. + 4 tsp.	2 qt. + 2qt.	Apply as a foliar spray to runoff in spring when plants are at the early to mid-flower stage. Complete coverage of leaves and green stems is needed.
	Roundup Ultra 4L (Glyphosate)	2.5 Tbsp.	1 gal.	Apply as a foliar spray in the summer after full bloom stage. Apply before Japanese beetles or other leaf-feeding insects damage leaves. Complete leaf coverage is needed. See labels for other glyphosate formulations.
	Spike 20P (Tebuthiuron)	---	---	Scatter pellets over root zone of plants in late winter, just before leaf flush. Use 0.75 oz. per 100 sq. ft. Do not apply near desirable trees or shrubs.
Osage orange (bois d`arc) Locust, Sassafras, Sumac, Sweetgum	Remedy 4EC (Triclopyr) + surfactant	4 tsp. + 4 tsp.	2 qt. + 2qt.	Apply as a foliar spray following full leaf development. Thorough coverage of all foliage is necessary for control.
Thistle, Canada	Cimarron 60DF (Metsulfuron)	0.01 oz.	1 oz.	Apply as a foliar spray in the spring when plants are at least 6 to 10 inches tall and before flowering. Thorough coverage is needed. Add a nonionic surfactant at the rate of 1 to 2 qts./100 gal. (2 to 4 tsp./gal).
Thistle, Musk	2,4-D Ester 4EC OR 2,4-D Amine 4L	2 Tbsp.	3 qts.	Apply ester formulation as a foliar spray to the point of runoff to small plants, less than 6-8 inches tall in late winter to early spring, or in the fall. If treating regrowth following mowing in the summer, use the amine formulation to reduce vapor drift.
Yucca	Remedy 4EC (Triclopyr) in diesel or fuel oil	5 Tbsp.	2 gal.	Prepare a 2% (by volume) solution of Remedy in diesel or fuel oil. Thoroughly wet the center of the plant including growing point and leaf bases to the soil surface. Complete coverage of leaves is not necessary.

PROPER STEWARDSHIP

Successful use of herbicides in weed management programs for pastures involves proper identification of the weed or weeds, selection of the appropriate herbicide(s), thorough familiarization with label directions and precautions, and proper, timely application.

The herbicide label not only contains a list of weeds controlled and directions regarding rate and application timing, but it also will give you directions regarding waiting periods before grazing, cutting hay or slaughtering animals following application. In general, waiting periods are more restrictive for lactating dairy animals than they are for beef cattle, dry cows or replacement heifers. Also, waiting periods are usually longer for hay cutting than for grazing. Waiting periods for recommended pasture herbicides are provided in Table 9.

Another important point to remember is that just because a herbicide is labeled for turfgrass does not mean that it is labeled for forage grass. In fact, the number of herbicides cleared for forage use is much smaller than the number cleared for turfgrass. Examples of herbicides cleared for turfgrass, **but not for forage**, include DSMA, MSMA, Princep, Surflan and many others. Use of non-registered herbicides is a violation of federal law, and it may result in illegal, detectable residues in milk or meat.

Table 9. Grazing, Hay Cutting and Animal Slaughter Restrictions for Pasture Herbicides (Days to Wait or Withdraw Animals)

	Non-lactating Cattle			Lactating Dairy Cattle		
Herbicide	**Grazing**	**Hay Cutting**	**Slaughter**	**Grazing**	**Hay Cutting**	**Slaughter**
Cimarron	0	0	0	0	0	0
Crossbow*	0	7	3	14	1 yr.	3
Gramoxone Max (dorm. bermuda)	40	40	N**	40	40	N
Grazon P+D	0	30	3	7	30	3
PastureGard	0	14	3	Next growing season	14	3
Redeem R&P	0	7	3	14	1 yr.	3
Remedy	0***	7***	3	14***	1 yr.	3
Roundup WeatherMax (spot tmt.)	14	14	N	14	14	N
Spike 20P[T]	0	1 yr.	0	0	1 yr.	0
Surmount	0	30	3	Next growing season	30	3
2,4-D	0	30	3	7	30	3
Weedmaster	0	37	30	7	37	30

**2 gals./A or less*

***N = no information on label*

**** = 2 qt./A or less*

[T] *These restrictions apply where no more than 20 lbs./A are used.*

DRIFT PREVENTION AND SPRAYER CONTAMINATION WITH PASTURE HERBICIDES

Movement of small amounts of commonly-used pasture herbicides (2,4-D, Banvel, Crossbow, Grazon P+D, Redeem R&P, Weedmaster, etc.) away from treated fields can cause serious damage to sensitive crops such as cotton, soybeans, tobacco, tomatoes and other vegetables, and ornamental nurseries. Two types of drift, physical and vapor, can occur. Physical drift is the movement of liquid spray droplets (usually the finer or smaller droplets) away from the target. Factors which increase the likelihood of drift include wind, high temperatures and a sprayer set-up that produces high pressures and low application volume (a large number of small spray droplets). Vapor drift is most influenced by air temperature. Some chemicals volatilize (change from a liquid to a gas or vapor) readily at warm (85 F) temperatures. The higher the temperature is above 85 F, the greater the risk of volatilization. While less obvious than physical drift at the time of application, vapor drift can be just as damaging.

Similarly, small amounts of herbicides such as 2,4-D in sprayers can create serious problems if the same sprayer is used to apply pesticides to crops such as tobacco, tomatoes, peppers, melons and other vegetables. It is strongly advisable to have a sprayer dedicated for pasture herbicides, since small amounts of herbicides are difficult to wash out of the sprayer. This sprayer should not be used to spray sensitive crops.

The following are suggestions to reduce the likelihood of drift from pasture herbicides:

1. ***Know adjoining farms and other properties well.*** Most producers are familiar with their neighbors and know if they grow sensitive crops. Check on when your neighbor, for example, plans to set tobacco, and which field he or she plans to use this year. Information of this nature will allow you to plan accordingly for individual fields. Also, be familiar with locations of gardens, outdoor tobacco float beds, greenhouses and container nursery operations, as the numbers of these are rapidly increasing in Tennessee.
2. ***Calibrate your sprayer for low pressure.*** High volume (20 to 30 gallons per acre), low pressure (20 psi or less) applications will reduce the number of "fines" or small spray droplets. One of the problems with low pressure in the past has been that flat fan nozzles would not develop patterns adequately at low pressure. Manufacturers have made great advances during the last several years in the development of low pressure air induction spray tips which will perform adequately at low pressure. If your farm supply store does not stock these tips, ask the dealer to order them for you.
3. ***Try to spray at a time of year when sensitive crops are not growing.*** This is often difficult to accomplish, because the optimum time for weed control may occur when a sensitive crop is in the field. However, some weeds, such as musk thistle, may be treated after mid-October with 2,4-D. This would be a good approach for a field across the fence from your neighbor's tomatoes or tobacco, in that you could treat at a time of year when the crop has already been harvested. This should also be considered in areas where cole crops (broccoli, cauliflower, cabbage) are grown, as most producers in Tennessee grow spring crops rather than fall crops of these sensitive vegetables.
4. ***Avoid spraying on windy days.*** Although this is common sense, it is one of the most effective ways to reduce physical drift. Unfortunately, windy conditions are common during March and April, the time of the year for best control of weeds such as buttercup, musk thistle, buckhorn plantain and dandelion. In general, calm conditions are more likely to be encountered either early or late in the day. With early morning sprays, a light wind blowing away from the sensitive crop may be better than calm conditions, because temperature inversions are less likely to be encountered. A temperature inversion is when the air near the surface is cooler than that above it. Inversions are more common in cooler months.
5. ***If sensitive crops are nearby, use the amine formulation of 2,4-D rather than the low volatile ester formulation.*** This is particularly important with late spring to summer applications, when warm (85 F) temperatures are likely to be encountered at or shortly after spraying. The amine formulation is much less volatile than the low volatile ester formulation. This is very important to remember, in that vapor drift will be worse under warm conditions, and that it can occur even a few days **after** application. Other herbicides that are temperature sensitive include Banvel, Crossbow and Weedmaster. Drift reduction measures such as low pressure, special nozzles, drift retardants, etc. help control physical drift, but do not reduce vapor drift.

POISONOUS PLANTS IN HAY CROPS AND PASTURES

In general, most poisonous plants are not very palatable and if given a choice, animals will not consume them. Factors that increase the likelihood of animal poisoning from plants include:

1. ***Lack of good forage.*** This is the most common cause of poisoning. While this can occur at any time of year with overstocking or deficient feeding, it is most likely in very early spring, late fall or winter, or during drought.
2. ***Deficient rations.*** Lack of required minerals or an unbalanced diet (only one type of plant) may cause an animal to graze on a plant not normally eaten.
3. ***Dry or partially dry water holes.*** This gives animals access to poisonous roots not normally exposed, or in some cases, high concentrations of toxic algae.
4. ***Waste or trash dumped in pastures.*** Hedge clippings and old garden refuse should not be dumped in pastures where cattle have access. Clippings of toxic shrubs such as yew, and weeds such as jimsonweed can create serious problems. Cattle, which are naturally curious, will seek-out these dump piles and forage through them.
5. ***Drought or frost.*** The sorghums (johnsongrass and sorghum-sudangrass hybrids), which normally are non-toxic, can develop dangerously high levels of prussic acid under conditions of drought, frost or trampling. The greatest risk is with early, light frosts in the fall. Also in dry summers, the sorghums will accumulate toxic levels of nitrates.
6. ***Overfertilization with nitrogen.*** Excessive nitrogen will lead to high nitrate levels in weeds such as johnsongrass and pigweed, and forages such as sorghum-sudangrass hybrids and pearl millet. Overfertilization problems are compounded by drought.
7. ***Herbicide applications.*** Some poisonous plants may become more palatable following application of herbicides such as 2,4-D and they may be grazed more readily. If poisonous plants are present in large numbers, grazing animals should be removed from the pasture prior to herbicide application, and they should not be reintroduced until the plants have turned brown and dry.

Table 10 provides a list of some of the more common toxic pasture plants encountered in Tennessee.

Table 10. Common Toxic Pasture Plants in Tennessee

PLANT	TOXIC PARTS	TOXIC PRINCIPLE(S)	REMARKS
Buttercups (*Ranunculus* spp.)	Stems and leaves	protoanemonin	Toxic principle acts mainly as an irritant. Flowering plant contains more toxin than young plant. Poisoning is rare.
Black cherry (*Prunus serotina*)	Leaves, bark, twigs	hydrocyanic acid (Prussic acid)	Primarily a problem with wilted, fallen leaves. Poisoning can occur in spring, summer or fall.
Sweet clover (*Melilotus* sp.)	Leaves and stems	dicoumarin	Toxic principle produced under certain conditions, such as molding hay.
Common cocklebur (*Xanthium strumarium*)	Seed and seedlings	carboxyotractyloside	Risk is greatest with young (cotyledonary) plants. Older plants are distasteful and less toxic. Swine are more commonly poisoned than cattle.
Bracken fern (*Pteridium aquilinum*)	All parts	thiaminase	More common in relatively dry sites. Poisoning is cumulative and may not appear until several weeks or months later.
Horsenettle (*Solanum carolinense*)	Primarily mature berries	solanine	Leaves also toxic, but to a lesser degree.
Jimsonweed (*Datura stramonium*)	All parts	atropine, hyoscy-amine, scopolamine	Seed are particularly toxic. Usually not eaten. Cows can be poisoned by consuming 0.5 to 1 pound of the green plant.
Johnsongrass (*Sorghum halepense*)	leaves and stems	hydrocyanic acid, nitrates	Cyanide poisoning can occur under drought, frost or trampling conditions. Nitrate poisoning is associated with over-fertilization and drought.

(Continued on next page)

PLANT	TOXIC PARTS	TOXIC PRINCIPLE(S)	REMARKS
Larkspur (*Delphinium* spp.)	All parts	delphinine, ajacine and other alkaloids	Most common in or near woods, old fields and gardens. One of the more toxic plants in Tennessee.
Milkweed (*Asclepias* spp.)	All parts	resinoids, alkaloids, glycosides	Consumption of 2 percent of body weight can produce symptoms of poisoning.
Perilla mint or Purple mint (rattleweed) (*Perilla frutescens*)	All parts	perilla ketone	Probably the most common cause of cattle poisoning in Tennessee. Poisoning most common in late summer or fall.
Black nightshade (*Solanum nigrum*)	Primarily berries	solanine	Toxicity of berries increases with maturity. Leaves also toxic, but to a lesser degree.
Pigweed (*Amaranthus* spp.)	Leaves and stems	nitrate accumulation	May accumulate nitrates after heavy fertilization or treatment with 2,4-D. Becomes more palatable after herbicide treatment.
Pokeweed (*Phytolacca americana*)	All parts	oxalic acid, phytolaccotoxin, various alkaloids	Roots are the most toxic plant part. Swine are most often affected due to grubbing of roots.
Sicklepod (*Cassia obtusifolia*)	All parts	Not clearly identified	Poisoning can occur from grazing, consuming green chop, or from hay if seed are present.
Bitter Sneezeweed (*Helenium amarum*)	All parts	dugaldin and a phenol	Usually only a problem in heavily contaminated hay, or in summer pasture where other forage is not available.
White snakeroot (*Eupatorium rugosum*)	All parts	tremetol	Poisoning can occur from consuming plant or milk from cows that have eaten the plant. More common in open, deciduous woods and along streams.

Precautionary Statement

To protect people and the environment, pesticides should be used safely. This is everyone's responsibility, especially the user. Read and follow label directions carefully before you buy, mix, apply, store or dispose of a pesticide. According to laws regulating pesticides, they must be used only as directed by the label.

Pesticides recommended in this publication were registered for the prescribed uses when printed. Pesticide registrations are continuously being reviewed. Should registration of a recommended pesticide be cancelled, it would no longer be recommended by the University of Tennessee.

Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others which may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product.

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